BULLETIN

OF THE

Ohio Agricultural Experiment Station

NUMBER 149. MARCH, 1904.

THE HARDY CATALPA AS A FARM CROP.

BY W. J. GREEN.

The growing of trees for posts has become a necessity, and the time has arrived when poles and railroad ties can be made profitable farm crops.

Harvesting may be begun in from six to ten years after planting by cutting for fence posts, and from five to ten years later some of the trees will be large enough for poles and railroad ties. A plantation, the primary object of which is to produce post timber, may, in due time, prove profitable for poles, ties and lumber.

In making the catalpa a farm crop the risk is small because the product, in some form, will always be in demand, and there is a wide limit as to the time of harvesting. Much of the work can be done at a season of the year when farm work is not pressing and but little skilled labor is required. Intelligent oversight is necessary, however. Many plantations which have been made show how costly mistakes and neglect may prove to be, hence a need of a careful study of the matter.

The selection of a site for the wood lot is often determined by the necessities of the case. A corner of the farm, cut off by a road or a stream; a hillside, or a ravine, or a rather poor and perhaps stony hill top, may be the only spot available. Upon many farms

there are fields which cannot well be cultivated because of frequent overflow. The banks of a stream may often be protected from washing by tree planting, and the same is true of many fields. Trees may often be planted for windbreaks and at the same time may yield a profit in posts or poles. They may also be made to beautify the landscape and yield financial returns as well.

It will thus be seen that, on most farms, the planting of trees, for posts, poles and ties, need not decrease the area of tillable land. In many cases, however, it would pay to devote tillable land to tree growing, especially where help is scarce and near railroads where the products can be marketed cheaply.

Investments could be made that would yield good returns without a large outlay for labor.

The fact that but few have awakened to the possibilities in such an investment ought to make it the more attractive. It is not so much the object of this bulletin, however, to present arguments in favor of tree planting as to show the best manner of accomplishing certain definite results.

A matter of prime importance in growing post, pole and tie timber is to select a tree which grows rapidly; is adapted to a great variety of soils; is but little subject to the attacks of insects and fungi and resists decay when put in contact with the soil.

The black or yellow locust has some of these qualities, likewise the osage orange and mulberry; but the Catalpa speciosa, or hardy catalpa, possesses more of them than any other tree.

The many virtues of this tree have been known for a long time, as shown by the following extracts from addresses made by Dr. John A. Warder. Before the Ohio State Horticultural Society he said:

"Another tree of rapid growth and promise of great utility is the catalpa, of which wonderful stories are told as to its powers of resisting decay. We may be encouraged to plant catalpa largely on account of its rapidity of growth and the good qualities of its timber. That the wood would be exceedingly valuable for lumber is demonstrated by the occasional specimens that have been sawed, finished and made into furniture. The open grain of the wood enables it to take a filler easily, while in color and marking there is scarcely a more beautiful lumber product. So well satisfied am I of the great durability of the catalpa, the fine polish it will take, *its great beauty* as a cabinet wood, and its value for railroad purposes, that I wish myself a young man, that I might plant a quarter section in catalpas."

Before the Ohio Agricultural Convention, 1880, in referring to Catalpa speciosa he made the following statement:

"We may be pardoned for having a state pride in this tree, for though not a native of Ohio, it was here that the distinctive characters of the *Catalpa spe-*

ciosa, the western species, were first pointed out and presented to the public. It was here that it was first planted and distributed by Gen. Wm. Henry Harrison, who brought it from its native home on the Wabash. It was here that its merits as a durable timber were published by him at an agricultural meeting in Hamilton county, when he urged his fellow-farmers, as early as 1825, to plant the tree extensively for its great value as a timber.

It was in Dayton, Ohio, that its great beauty as a shade tree was observed by Dr. J. Haines, who propagated and distributed the plants that now ornament the streets of that city. In 1853 it was recognized as distinct from the catalpa of the nurserymen, that had been brought from the eastern states, and was then published in a magazine devoted to horticulture and rural affairs that was printed in Cincinnati (*Western Horticultural Review*, Aug., 1853.)

Further honors to the catalpa and to our state have resulted from a great devotion to the timber interest manifested by Mr. E. E. Barney, of Dayton, who has bestowed much time and money, in the most disinterested manner, in the collection and diffusion of information ("Facts for Information on the Catalpa Tree") respecting this valuable tree, and in sending out its seeds, some of which have reached far distant lands on other continents.

From all which it appears, that though itself a native of another region of our country, the merit of the introduction of the *Catalpa speciosa* is due to the intelligence and energy of the citizens of our own state. Though it is not pretended that we have originated or created a new tree, we have presented to the world one that had heretofore escaped the observation and notice of the botanists."

Mr. E. E. Barney, of Dayton, O., who employed a horticulturist of many years' experience to study the catalpa for him in southern Illinois, and at other points, makes the following statement:

"He sends a piece of fence post with the bark on perfectly sound, that has been in the ground forty-seven years. He says the gard n round which these posts were planted forty-seven years ago has been removed and the posts taken up and re-set, and that the owner, Mr. Murphy, says they are good for the balance of a century."

Not many catalpa plantations, however, have been made within the state, owing to the fact that the need of such timber has not been seriously felt.

Another fact has had some influence against the planting of catalpas, viz: a worthless species has often been substituted by seed dealers and nurserymen, hence many plantations are unsatisfactory because of the crooked, irregular growth of the trees. The influence of this costly mistake will be felt for a long time, and it is with the hope that something may be done to counteract it that the following extract from Bulletin 26 of the Illinois Experiment Station is offered:

"*Catalpa bignoncides.* (*Catalpa catalpa*) Since eastern nurserymen supplied the western parts of the country with most of the nursery grown trees, and since this tree produces within six to ten years an abundance of seed, it need not be surprising that even in the areas in which the hardy catalpa naturally existed the seeds for planting were mostly gathered from cultivated trees, and so from the eastern or tender kind. This seed was planted in the spring of

1869 and seedlings were transplanted 2 by 4 feet apart in 1871. In five years the average height was 16 ft. and the average diameter of the stem 2¼ in. The height of the better specimens in 1886 was 28 ft. 3 in. and the circumference of trunk 20 to 21 in. The better specimens at the present time (1893) are 7 to 9 in. in diameter and 35 to 38 feet in height. Very few of them have straight trunks as much as ten feet in length, and most of them are so crooked that it is hard to get good 7 ft. posts without considerable waste. Taking crooked and straight, together with what might be split, the trees would make an average of about four posts each. But few of the trees are perfectly sound.

Catalpa speciosa. The seeds from which these trees came were planted in nursery May, 1876. When two years old the young trees were moved to the permanent plantation and set in rows 8 ft. apart, 4 ft. apart in the rows. From the first these seedlings took an upright growth quite different from that of the tender variety. The trees continued to grow luxuriantly, forming straight trunks, furnished with coarse and distant, but symmetrical, branches. Not a bud or branch has been noticeably injured by frost. The average height of the better trees in 1886 was 17½ feet, and circumference of trunk a little over 14 in. This was for six years' growth, or an average of about 3 ft. increase in height per year. Quite a number of the trees have been taken out for transplanting, leaving them, so far as thinning has gone, 8 ft. apart each way. The trees now (1893) are 30 to 34 ft. high and 7 to 9 in. in diameter at one foot from the ground. Unlike the tender catalpa these decrease rapidly in size for the first 3 or 4 feet. After that they carry their trunks straighter and hold their size better than *C. bignonoides.* The ease of propagation, the usual freedom from disease and injury, the easy success in transplanting, the wonderful rapidity of growth, the excellent form of the tree and the value of the wood eminently distinguish this species as valuable for timber plantations. Its home is upon rich "river bottoms," where the trees attain a height of 80 feet and a diameter of trunk of 2 to 3 feet or equal to that of the white ash. But on poor soil it is probable that the mature trees will be smaller than several of the oaks and other first-class forest trees."

At least three other mistakes have been made in planting catalpa trees, all of which have worked injuriously against the hardy catalpa, and to some extent, against forestry in general. These are (1) too close planting, (2) neglect of thinning, and (3) improper pruning. In nearly all of the earlier plantations the trees were set four feet apart each way and allowed to struggle for existence after two or three years' cultivation.

Comparatively little has been realized from such plantings; the growth has been unsatisfactory; the trunks have been crooked, and the branches, instead of dropping off, have remained to form entering places for fungi.

Doubtless it was the intention of those who made these first plantings to thin the trees at the proper time; at least one of those most prominently engaged in such work had that thought in his mind, as shown by the following: Referring to an article by a correspondent from Kansas, Mr. Robert Douglas, in *Garden and Forest* for January 3, 1894, says:

"I can confirm all that he says about the durability of catalpa-wood and its value for cabinet-work. It is a misfortune, however, that he should have accepted as true the statement which he says was prevalent ten years ago to the effect that 'Catalpas planted four feet apart each way, and cultivated three or four years, would every one make a post in from eight to ten years.' Perhaps such statements did appear in the agricultural press, but surely no one who has observed the growth of trees, either in the forest or in artificial plantations would have believed this possible. * * * * It is only on paper that men plant forests which grow in this prosperous way. 'Set out your trees four feet apart,' says the indoor forester, 'then the third year thin out every alternate tree in the first row, and take out the second row entirely, and you will have trees standing eight feet apart, exactly one-fourth of the number originally planted, all vigorous and happy, and growing into timber at railroad speed.' But if any plantation was ever actually thinned out in this geometrical fashion I am sure it must have been seriously damaged."

The following from *Arboriculture*, Jan. 1903, shows what the prevailing practice has been and makes it clear that a better and more rational plan must be followed in order to insure success in growing catalpa:

"Almost every artificial forest plantation in America has been made upon the old theory that side branches of trees must be eliminated by close planting; that forest conditions must be maintained by the dense shade of many trees.

The majority of such plantings has been at 4x4 feet distant with but comparatively little thinning.

We now have in consideration the catalpa tree which, when once established, is a remarkably strong, vigorous growing tree. At 4x4 feet distance, or 16 square feet surface for each tree, the roots will occupy all the ground in two years after planting.

In four years there will be a struggle for existence among the roots and a corresponding decrease in vitality and power to produce an efficient top.

Forest conditions are thus maintained at the expense of wood growth. Every plantation so made has been a failure and always must be.

The theory adopted by *Arboriculture* is directly opposed to this.

A strong root system must be developed and ample room given the tree, so that the vital part of the tree, and which is never seen, lying beneath the ground, shall have room to expand and gather strength for the support of the tree.

In the native forests of catalpa the trees are tall, straight, with but few branches along the trunk.

This is nature's method of reproducing a forest of catalpa. When a tree is felled, a shoot from the stump, having the force of the entire root system, quickly springs up into a tall, strong, branchless stem, in a few years becoming a full-grown tree.

Arboriculture, following after nature's method, recommends the development of a strong root system, regardless of the irregular growth of the top during two or three years, after which the stem is cut off at or near the ground while the tree is dormant.

The upright stem results; all surplus buds that start should be removed leaving but one, the strongest.

The distance, 16x16 feet, seems to be the most satisfactory for a permanent plantation—170 trees per acre. But in order to occupy the ground, prevent injury by winds and properly shade the ground, four times as many trees are planted, or 8x8 feet, being 680 trees to the acre.

As soon as these have attained a suitable size, in seven to ten years, the temporary trees are removed and used for fence posts, mine timbers and other uses.

The rapidity of growth will depend upon the character of soil, length of season, cultivation given during the first three years, and moisture obtainable.

Shade and forest conditions, so-called, secured at the expense of root vitality, *will not compensate* for loss of vigor and absence of good cultivation during the first three years. After the first year cultivation should be very shallow.

Branches of catalpa are very persistent. They do not fall away when dead, but remain as dead pins. Each annual growth of new wood encloses them until, as the tree becomes mature, these dry sticks lead from the heart of the tree to its circumference. Shrinking away from the surrounding wood a cavity is formed into which air and water find their way and carry germs of decay.

The catalpa must be hand pruned if one's bank account is to be benefitted.

The best instrument for this purpose is a three-inch, sharp chisel upon the end of a long pole. An upright thrust, or a slight blow with a mallet, removes the limb close to the tree. This soon becomes calloused over and covered with new wood.

No branch along the trunk should exceed two inches in diameter before removal."

Extracts from Bulletin 108, "The Hardy Catalpa," issued by Kansas Experiment Station:

"Comparing the plantings originally 4x4 feet and 4x8 feet, the thinner plantings have given the best results. Ten rows, 4x4 feet, 117 feet long, contained 251 trees, having 85 good posts. Ten rows, 8x4 feet, 117 feet long, grew 228 trees, having 280 good posts. The trees in the wider rows have a greater average height and diameter; the average diameter in the planting 3x8 feet apart being slightly under six inches; in the rows 4x4 feet apart the average diameter is nearly four and one-fourth inches. The average height is about the same, eighteen feet.

In some cases, where trees were thinned by cutting off just above the ground, the new shoot from the stump made such a straight rapid growth that the cutting back seemed to secure the formation of straighter posts. As might be expected, the second growth posts grow to a suitable size for use in less time than was required for the first growth of trees. The comparative value of the first and the second growth for posts is a subject for further observation.

The catalpa plantings made by the College and the Experiment Station have given encouraging results. On very poor soil the catalpas have been a paying crop. Almost any other cropping of this land would have reduced its fertility, while the crop of trees has unquestionably been beneficial both by preventing washing and by the addition of some humus.

On good soil the growth has been proportionately better. The trees have made a more rapid and vigorous growth, producing trunks of suitable size for posts in from seven to ten years, and in twenty years trees have grown to a size sufficient for heavier uses, or for lumber for finishing or cabinet work."

The cost of growing an acre of catalpa trees must vary according to local conditions; likewise the value of the crop will depend upon the soil and care given, so that an estimate as to the probable profits can be approximate only.

Mr. John P. Brown, editor of *Arboriculture*, estimates the cost of growing an acre up to eight years to be $75 and by some the cost is put at a lower figure. The following estimate is from bulletin 108 of the Kansas Experiment Station:

"Careful estimates based on the Yaggy forest give total cost of growing and marketing timber on one acre for ten years as $51.70; gross value of product in ten years, $267.15; net profit $215.45; net profit, less six per cent. compound interest on expenditures, $197.55 per acre; net annnal profit for first ten years, $19.75; owner's estimate of present gross value of product (three years later than above valuation) $400 per acre; annual income of plantation at present as estimated by owner, $50 per acre."

Many quotations from good authorities could be made regarding the hardy catalpa, and almost without exception they would be commendatory. The object of this bulletin, however, is not so much to show the value of this tree as to point out the best method of treating it so as to make it a profitable farm crop.

The catalpa is easily grown from seed and in some cases it may be advisable to grow the trees instead of buying them. If one knows how to distinguish the true speciosa and can find seed bearing trees of that species, it may be as well to take no risks of getting the wrong kind by buying trees.

There are two very common species of catalpa which are found in nearly every neighborhood, both of which are undesirable. Both of these are more spreading and bushy than the speciosa. The filaments, or threads, at the ends of the seeds of these two forms of catalpa are drawn together, while those of the speciosa stand out parallel to each other like the hairs in a flat paint brush.

The inferior kind seed very freely and the seeds are easily gathered, as they are nearer the ground, but the pods of the speciosa are more scattered and higher up.

The seeds may be gathered at any time during the winter, but it is advisable to secure them as soon as the leaves fall in order to prevent loss by the opening of the pods.

The seeds should be kept over winter in a dry, cool place. They are to be sown about the first of May, or as soon as the ground is in good condition.

Soil that is rather better than the average should be taken for a seed bed and it needs to be put in good condition by careful plowing and harrowing.

The seed is to be sown in drills, made with a hoe or a small hand cultivator with a single tooth.

Scatter the seed in the drills about an inch apart, or even closer, and cover not more than half an inch with mellow soil. The rows may be eighteen inches apart for hand cultivation or far enough to work with a horse. Keep the ground free from weeds during the summer.

In the fall the trees ought to be from one to two feet in height and a little larger than a lead pencil.

They may be transplanted in the fall on sandy soil but on account of heaving out during the winter it is safer to defer transplanting until spring. The seedlings may be allowed to stand in the seed bed during the winter but it is better to take them up in the fall and heel them in, selecting a spot where water will not stand.

If the field which is chosen for the permanent plantation is tillable it should be put in as good condition as for any farm crop and the trees planted during April or May. In well prepared ground planting is a simple matter.

Thrust a spade the full length of the blade into the ground and work it back and forth, thus making a hole for the tree. If the root is too long for a hole of this depth cut it off so that the tree may stand about as deep in the soil as it stood before. Place the roots of the tree in the hole and thrust the spade in again two or three inches to one side and press the soil firmly against the roots and then fill the hole with the spade or feet. Bring the feet together on either side of the tree and firm the soil well by tramping.

A crop of corn or potatoes may be grown between the trees the first season, and the cultivation which is necessary for the crop will be sufficient for the trees. The second season a crop may be grown between the trees also, but as the trees will shade the ground considerably there is not much to be gained by cropping, especially when the difficulty of plowing the ground is considered. In most cases a better plan would be to work the ground first with a disk harrow and then continue the remainder of the season with a common harrow.

This plan might be modified by sowing crimson clover in August or September, or cow peas or soy beans in June or July. Whatever crop is sown it should be one of the legumes and it need not be turned under.

The third season cultivation may be impracticable, although in some cases it may be continued the same as in the second. The growth of the trees will determine the matter largely, but in case a start of crimson clover has been secured it would be well to leave it undisturbed.

After the first season cultivation should be shallow, so as not to mutilate the roots of the trees, and should be so managed as to conserve moisture to the greatest possible extent. At the end of the second season many of the trees will be ten feet in height and two inches in diameter at the base. The roots of such trees will meet and pass in the middle of the rows, filling the entire space with a network of rootlets. It is evident that cultivation must be done with care, also that moisture must not be allowed to waste. The condition needs only to be understood in order to realize the necessity of careful work. A catalpa grove cannot be treated in the same manner as a young orchard, as the growth is more rapid and the trees are closer together than fruit trees.

In some cases cultivation may be impracticable, such as stony fields, newly cleared lands and steep hillsides.

On stony ground and steep hillsides the ideal method is to dig with a mattock a small space, about two feet square, where each tree is to stand, and then plant as advised in plowed ground. After planting success is more certain if each tree is mulched with straw, or some material which will keep the ground moist. Seeding with clover, if practicable is advantageous also.

On ground which is newly cleared the same method of planting may be followed and clover seed sown, but the sprouts which start from the stumps of the trees which have been felled will need to be cut at least once during the season and may be thrown about the young trees to serve as a mulch.

It is seldom advisable to plant catalpa trees where either mulching or cultivation cannot be practiced. Some of the trees may grow and make good specimens without care, but the result will not be satisfactory where no attention is given them.

All live stock, except chickens, should be kept from the catalpa grove for at least three years, but after that hogs might not injure

the trees, although we know of no groves having been used in this manner. In case shade for live stock is the primary object and timber the secondary, the catalpa is as suitable as any tree.

Pruning is a matter of the utmost importance in growing catalpa trees. Much has been said regarding the necessity of securing forest conditions, *i. e.*, the shading of the soil by means of a thick growth, in order to prevent the loss of moisture; to discourage the growth of grass and weeds; to kill off side branches and to insure an upright growth of the trees.

This plan has been sufficiently tested to show its impracticability. A catalpa grove is as much an artificial product as an apple orchard. Forest conditions in a catalpa plantation can be secured only at the expense of growth. Artificial conditions are more economical, at least at first, but later, natural conditions may be better.

A strawberry plant is often the worst weed in a strawberry bed, and all surplus trees in a catalpa grove are weeds, or often worse than weeds. Trees can compete with grass and weeds far more successfully than with other trees, but competition of all kinds should be reduced to a minimum.

Cultivation does this for other crops and it serves the same purpose for the catalpa. If one would grow a catalpa grove successfully he must reduce the struggle for existence to the lowest limit by artificial means. Side branches are more economically removed by pruning than by close planting. An upright growth can be secured at less cost than by overcrowding of the trees. In close planting the original cost of the trees is several times greater than need be; the cost of thinning is considerable and the damage to the permanent trees is very great. Pruning is done for two purposes: (1) To secure a straight trunk or stem, (2) to secure a clean stem.

It often happens that a young catalpa tree will have two stems, or one crooked stem. In either case overcrowding would do no good, for trees of these classes are found no matter how closely they are planted.

The only feasible plan is to cut such trees off close to the ground and let them start again. It is better to do this the latter part of the winter, or early spring, after the trees have made two seasons' growth in the grove.

Preserve only one sprout and the growth will often be ten feet or more the first year. In a catalpa grove growing on the Station

farm are trees planted in 1901 and cut back to the ground in 1903, which made a growth during the summer following of 11½ feet and have a diameter at the base of 1¾ inches. Trees in the same grove cut back in 1902 are 12½ feet tall and 2½ inches in diameter. In the same grove are trees which were straight and did not need to be cut back that have made a growth in the three years of 13 feet in height and 2¾ inches in diameter. Another season's growth will make the trees cut back in 1902 equal in size to those not cut back. Cutting trees off close to the ground does not make any material difference in the date of harvesting.

It is the only way to insure trees with straight trunks and it has the further advantage of reducing the amount of pruning, because there are but few side branches on sprouts which spring from the stumps of trees that are cut back.

The best time to do all pruning is late in winter or early in spring, although no harm will be done by cutting off very small side branches in early summer. The removal of much foliage in summer time, however, is harmful to the trees.

Regarding the distance the trees should be apart in the permanent plantation, it is difficult to lay down a definite rule. Much depends upon the purpose for which the trees are intended, also upon the soil, and we need more facts before speaking too positively on this point.

The trees may be set quite near together, if thinned at the proper time, but it is a safe rule to adopt in practice, never to plant so many trees on the ground that, when thinning is to be done, the trees which are taken out must be thrown away. Trees may be set as near as 4x4 feet and will grow vigorously for two or three years, but when planted so closely as this, thinning must be commenced before those which are taken out are of marketable size.

This is not only a waste but occasions needless labor and is harmful to the permanent trees. Whether 8x8 feet or 10x10 feet is the proper distance is not surely known, but if set 8x8 feet it is known that within ten years many of the trees will make from one to three posts. When this time arrives it is better to begin thinning.

In the thinning some would take out every other row, while other would, in addition, take every other tree from the permanent row also, or three-fourths of the original number. Others would take the weakest of trees, regardless of where they stand. Doubtless the practice must be regulated by the conditions and according

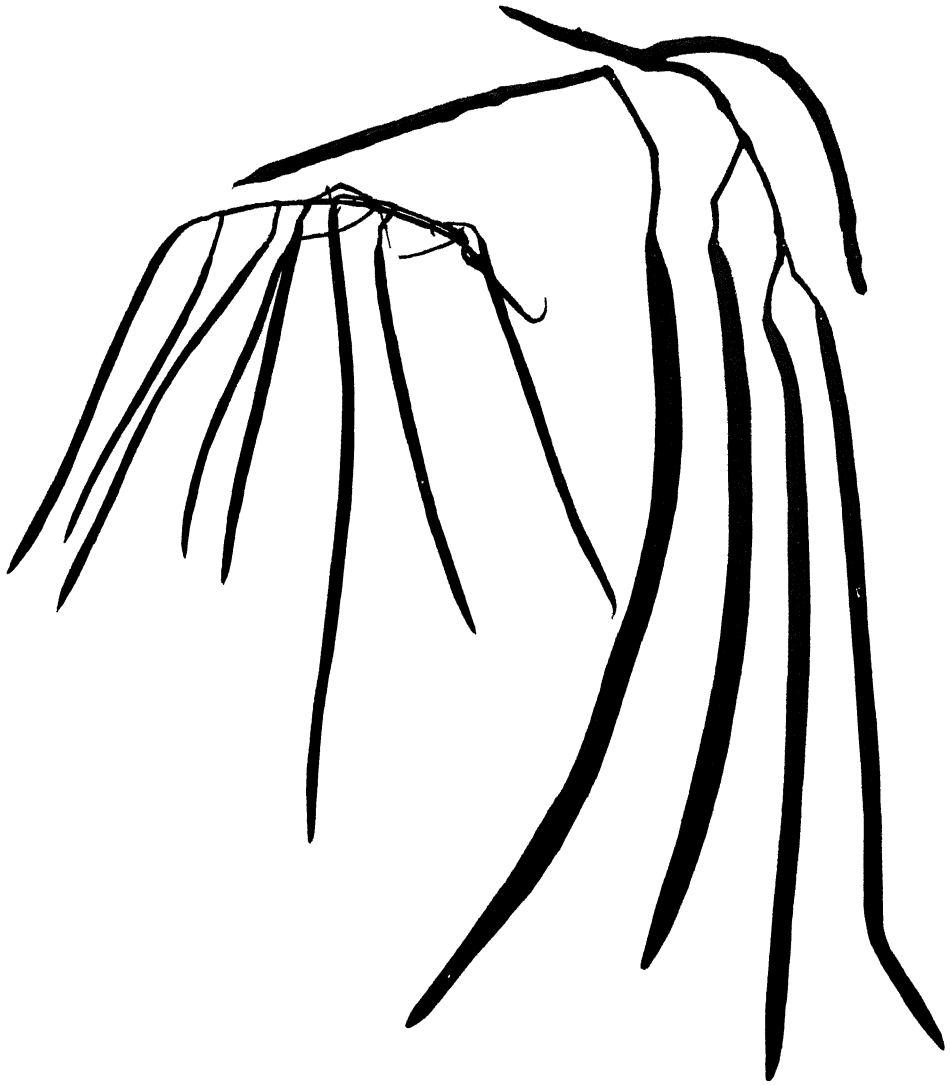
to the purpose for which the grove is intended, but according to our present knowledge 8x8 feet appears to be a safe distance, provided thinning is begun early enough. If posts alone are to be harvested all of the trees may be cut at the same time, if desired, and the sprouts allowed to grow to make another crop.

If only a part of the trees are cut for posts and the others left for other purposes, the sprouts from the stump will be less vigorous than if all were cut.

The above discussion is intended to be preliminary to a fuller account of forest tree planting, to be issued within a year or two. The Station has made a fair beginning in growing trees for posts, poles and ties and the intention is to extend the work so as to include a greater variety of forestry questions. For the present, however, more attention will be given to the simpler problems which appeal particularly to farmers. To this end co-operation is desired. Trees are to be sent out to various parts of the state for experimental plantings. These plantings are to be studied as carefully as circumstances will permit, and it is desired also that wherever tree plantings for timber of any kind have been made those who have such or know of those who have will inform the Station.

The Station will also act in an advisory capacity so far as practicable.

Those having lands which it is desired to use for forestry purposes should communicate such intention to the Station and if possible, help in formulating plans will be given, and, it some cases, trees will be furnished for experimental work.



Seed Pods of Catalpa, speciosa on the right, Bignonoides or Hybrids to the left

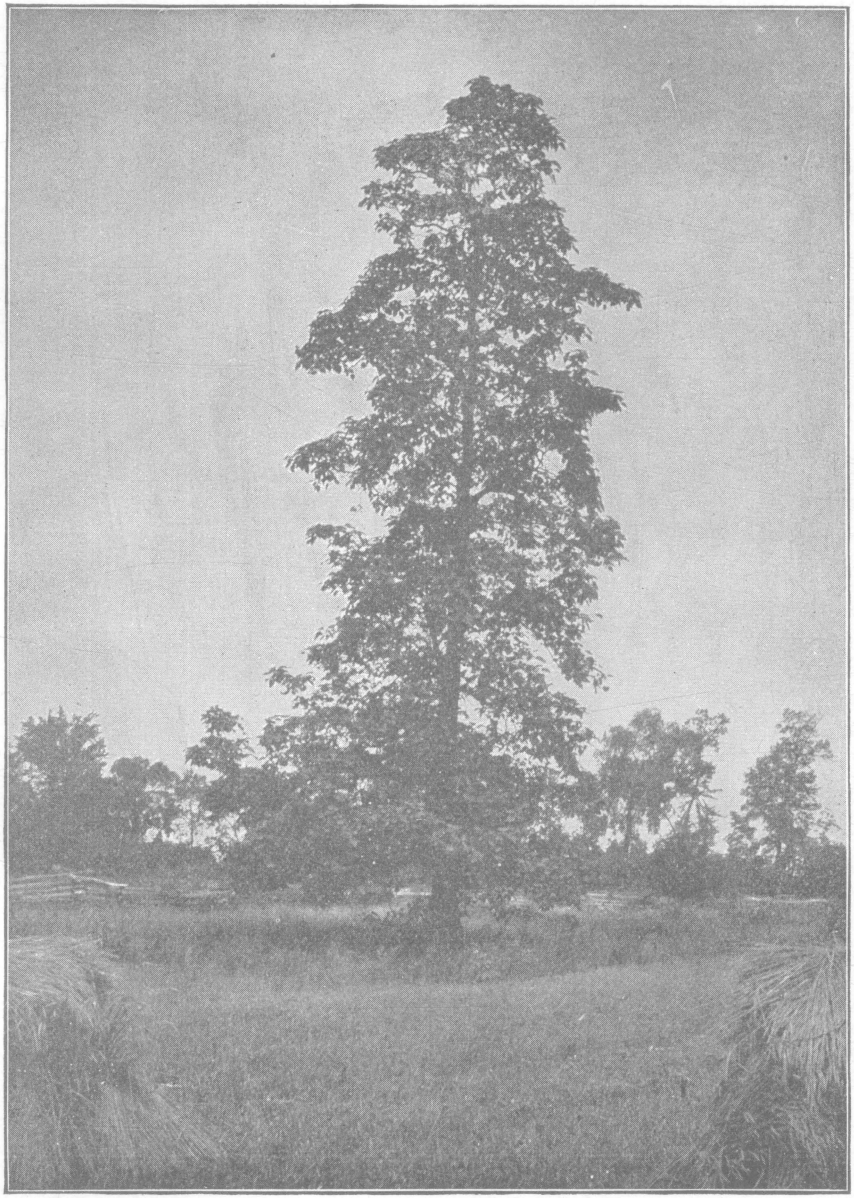
From Arboriculture, Courtesy of John P. Brown.

Catalpa and Locust trees in the seed bed.

Locust trees, one season's growth after transplanting.

Catalpa trees, one season's growth after transplanting.

Catalpa grove at the Station, 3 seasons' growth.



A Noble Catalpa tree, on the Wabash.

From Arboriculture, Courtesy of John P. Brown,

How Catalpa speciosa grows in nature.

From Arboriculture, Courtesy of John P. Brown.

Catalpa speciosa in Forest.

From Arboriculture, courtesy of John P. Brown.